Statement of

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Before the

Subcommittee on Space and Aeronautics
Committee on Science
House of Representatives

October 3, 2002

Mr. Chairman and Members of the Subcommittee: It is a privilege to be here today and report to you on the progress of NASA's Near Earth Object (NEO) search effort. In addition to identifying NEOs, this program is also focused on determining the shapes, densities, internal structures and compositions of the NEOs and their parent population, the main-belt asteroids. I will also share with you my views on the future role of NASA with respect to exploration of these bodies.

Background

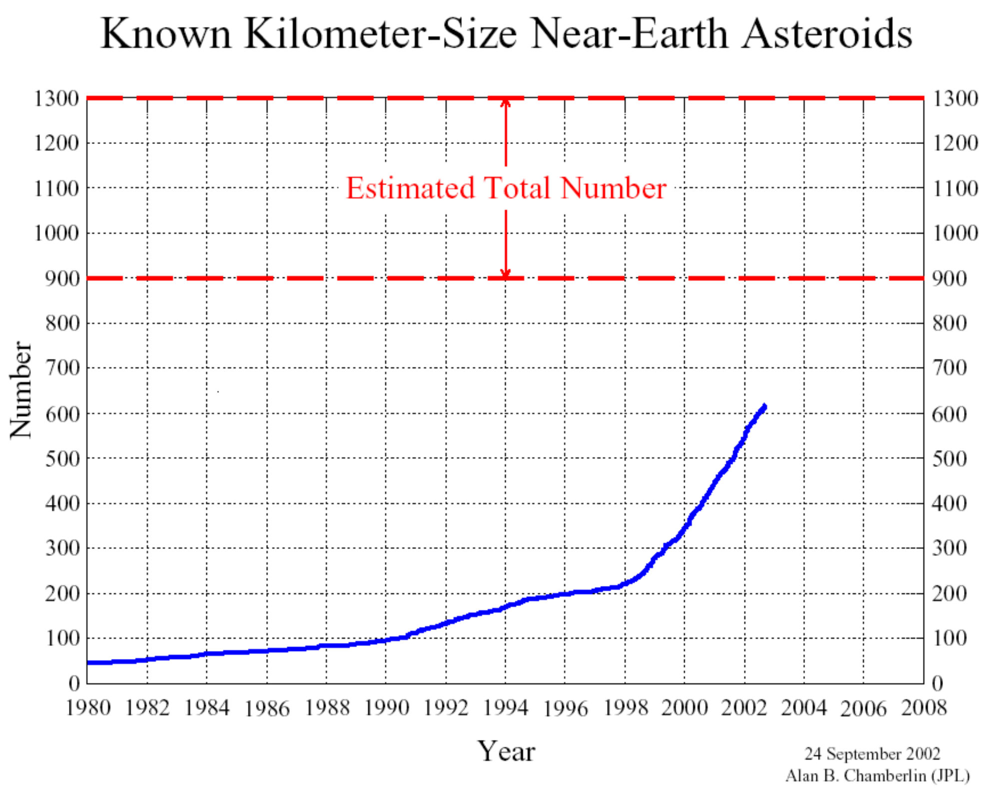
NASA's NEO Program makes ground-based observations with the goal of identifying 90 percent of those NEOs that are 1 km or larger and characterizing a sample of them. This is a ten-year program, which began in 1998 and should be completed in 2008. (It should be noted that NASA had begun searching for NEOs many years before this program officially started.)

The threshold size for an asteroid striking the Earth to produce a global catastrophe is 1 km in diameter. NASA has an active program to detect such objects that could potentially strike the Earth and to identify their orbits. The best current estimates are that the total population of NEOs with diameters larger than 1 km is about 1000. The 1-km diameter limit for an NEO was set after extensive discussions within the scientific community to determine the size of an object that would likely threaten civilization. This community consensus is codified in the Spaceguard Report and in the Shoemaker Report. For comparison, the object that likely caused the extinction of the dinosaurs was in the 5-10 km range. The current survey of NEOs in that range is considered complete.

Status: NASA's NEO Search Program

As of the end of September, NASA has detected 619 NEOs with diameters larger than 1 km. We are currently discovering about 100 per year. At the present time, we have six groups which are funded by NASA's Near Earth Objects program to conduct this type of research. These groups, selected though peer review, have ten telescopes among them searching for NEOs. One of these groups just completed (and another one is about to complete) major upgrades to its facility; therefore, we expect this pace of discovery to continue, if not increase. In some cases, the search programs are not able to obtain the number of observations required to determine the orbit elements of certain objects to sufficient accuracy to fully characterize the orbital parameters. These objects require additional astrometric observations, commonly called "follow-up observations." We have also funded four investigations to obtain astrometric follow-up observations of those objects that cannot be easily followed by the primary search programs.

Now, how well are we doing? I am happy to report that we are doing quite well; in fact, we are even a bit ahead of schedule. The graph below shows the discovery of NEOs over time and also the upper and lower boundaries of the likely population of NEOs with diameters larger than 1 km.



There have been various reports to the effect that NASA would not reach its metric – 90 percent of all the NEOs with diameters larger than 1 km – until many years after the end of 2008. However, these analyses have been based on the performance of individual search efforts, and they have tended not to use the current performance of the NEO search effort as a whole. As with most things, experience increases proficiency; therefore, we expect the rate of detection to increase. Even if we were to stay at our current rate, however, we are more than halfway to our goal of 90 percent by the end of 2008.

That does not mean we will grow complacent; we intend to continue to vigorously pursue detection of NEOs. In fact, we anticipate even better results due to technological developments such as better detector arrays, migration of existing search efforts to larger telescopes, and additional telescopes dedicated to the search program. In short, we are working to achieve both our goal and our metric and expect to be successful at both. One unanticipated result of the NEO search will be a list of over 1,000 potential candidates for future space science missions.

NASA's Future Role with Respect to NEOs

Next I would like to turn to another question. What should NASA's role be in the future? NASA is a space agency. While we are proud of our success in implementing the Congress's direction to us with regard to the search for NEOs, we do not feel that we should play a role in any follow-on search and cataloging effort unless that effort needs to be specifically space-based in nature. There are other agencies with far more expertise in ground-based observations that would be more suitable candidates to lead that portion of a future NEO endeavor.

NASA does, however, continue to have a large role to play in the scientific space exploration of asteroids. The frequent access to space for small missions offered by NASA's Discovery Program has benefited the study of asteroids and comets as no other program to date. The first in-depth study of an NEO, Eros, was performed by the NEAR-Shoemaker mission. The body of data returned by NEAR-Shoemaker was so large, and the quality of the data so high, that NEAR's database will require years of analysis. Just this year, we initiated funding for the first 17 investigations of that data. NEAR-Shoemaker's exploration of Eros will be followed by detailed exploration of two other asteroids, Vesta and Ceres, by the upcoming DAWN mission, currently scheduled to launch in 2006. There is no reason to expect that science-driven exploration of the asteroids, and of course NEOs, will not continue through the Discovery program. We believe that the critical measurements required for developing potential mitigation efforts are substantially the same as those required to achieve the pure scientific goals identified for these objects. We must be able to understand and characterize these objects before any mitigation efforts are even considered.

In addition to NEAR and DAWN, NASA has several other missions dedicated to studying comets and asteroids, such as Deep Impact and Stardust. Our total investment in understanding these bodies, both in the past and in our current FY 2003 budget run-out, is approximately $1.6 billion. That does not even take into account those spacecraft that have provided "bonus" information, such as Galileo, which found a moon orbiting asteroid Ida, and Deep Space 1, a technology demonstration mission that performed a close-up fly-by of comet Borelly. NASA deeply regrets not having the potential discoveries from the recently failed CONTOUR mission, which was to have studied Comets Encke and Schwassmann-Wachmann 3.

NASA's bold new technology initiatives, the In-Space Propulsion (ISP) Initiative and the Nuclear Systems Initiative (NSI), together offer new opportunities to enable capable new missions to NEOs early in the next decade. Improvements in solar-electric propulsion and development of solar sails are examples of new capabilities that might allow a spacecraft like NEAR-Shoemaker to visit many NEOs during a single mission rather than just one (and at the cost of a Discovery mission). If we are ever faced with the requirement to modify the motion of an NEO over time to ensure that the object will not come close to the Earth, nuclear propulsion may very well be the answer. The Nuclear Systems Initiative could address two elements in understanding the potential hazards of NEOs by: (1) providing technologies that could significantly increase our ability to identify and track NEOs, and (2) to possibly – in the future – provide sufficient power to move an Earth-intersecting object. The NSI could enable power and propulsion for an extended survey (in one mission) of multiple NEOs to determine their composition, which is a critical factor in understanding how to mitigate the risk of an Earth-intersecting object. In the future, the technologies under development by the NSI could provide us with the means to redirect the path of an Earth-intersecting asteroid, once we understand the orbital mechanics of these objects sufficiently to understand how to do this. These programs are being developed to serve a wide range of needs across NASA, but they will most certainly prove beneficial for space missions that help us to better understand and characterize NEOs.

What Should the Nation be Doing beyond the Current Goal?

I feel that it is premature to consider an extension of our current national program to include a complete search for smaller-sized NEOs. There are several reasons for this belief. The first is that we need to have a better understanding of the true size of the population down to at least 100 m. How will we get the improved data we need on this population? We will obtain the necessary data from the existing NASA search effort for NEOs. The search program now finds about two NEOs with diameters less than 1 km for every large one (diameter greater than 1 km) that we find. In addition, we are supporting a search program which is optimized to detect smaller NEOs. We expect by the end of this decade to have a much better picture of the true size of the population, and hence, what will be required to detect all of them.

The second issue is how such a search could be most efficiently and cost-effectively implemented. Two groups that wish to build large survey systems have argued that the search goal should be extended to 300 m. NASA has at least two concerns with this proposition. First, we do not possess a non-advocate trade study to tell us how best to do such a search. For example, one issue to be addressed is whether it would be better to build one large 8-m class telescope or 2 4-m search telescopes. At these sizes, is a space-based system an option? Second, why 300m? The present limiting diameter of 1 km was the product of a broad public discussion. When we have another broad public discussion, the answer could be: "Leave the present limiting diameter as it stands." Or, perhaps the result of broad national debate on this issue would be: "Catalog the population down to 100 m." We at NASA don't know the answers to these questions, and we believe that further commitments to extend the search are simply premature at this point.

Within the Office of Space Science, the Solar System Exploration Division Director has appointed a small Science Definition Team (SDT) to consider the technical issues related to extending the search for NEOs to smaller sizes. The goal of the SDT is to evaluate what is technologically possible today. The scope of the SDT does not include consideration of any change to our present NEO search goal.

Conclusion

NASA has made impressive strides in achieving its goal of cataloging 90 percent of all Near-Earth Objects with diameters of more than 1 km and characterizing a sample of them. We are currently ahead of schedule with respect to having this effort completed in the 2008 time frame. While NASA certainly agrees that because these objects pose a potential threat to the Earth, they should be studied and understood, we respectfully defend our position that any expansion of NASA's current NEO effort is premature. Before any further effort is undertaken, we would want input from the scientific community as to how this subject should be approached, and if indeed NASA is even the proper agency to lead this type of an undertaking. I will be happy to expand on any of these thoughts during the question-and-answer period. Thank you, Mr. Chairman and Members of the Subcommittee.